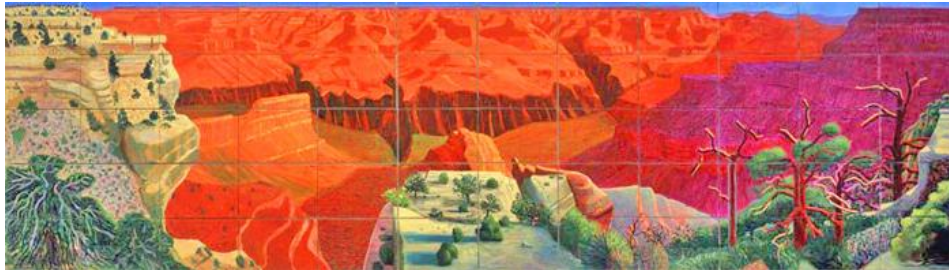


# IN DIALOGUE WITH NATURE

**Bill Griesar and Jeff Leake**



Certain drugs provoke compelling visual distortions and hallucinations, increase the intensity and salience of what you perceive, depress areas of the brain that let you introspect, and experience a personal sense of self, and make the ordinary stand out powerfully as never before...

Artists have intuitively manipulated these same systems to communicate emotional states and visual phenomena since first putting pigment on a cave wall. This session will bring together landscape art, hallucination, and the science of perception.

# nwnoggin.org

Neuroscience Outreach Group: Growing in Networks...



- Bill Griesar, Neuroscience Coordinator
- Jeff Leake, Arts Coordinator
- Dedicated volunteers from PSU, WSUV, OHSU, PNCA



nwnoggin.org

# Why art - and brains..?

- Motivation and engagement
- Exploration, creativity, and discovery
- Personal relevance of STEAM material
- Internships, jobs and careers





# Who is involved?



- *Academic priority* K-12 students
  - Portland/Vancouver Public Schools
- Art and neuroscience undergraduates
  - Pacific Northwest College of Art, Portland State University, Washington State University Vancouver
- Art and neuroscience graduate students
  - PNCA, PSU, WSUV, Oregon Health & Science University
- Working artists and scientists

# Where do we go?

- K-12 schools
- Universities
- Retirement communities
- Hospitals
- Science museums
- Art museums
- Conferences
- Homeless shelters
- Bike shops, pubs
- *Thousands reached*

**NW Noggin**  
**Collaborative neuroscience outreach  
in Portland and Vancouver**

Graduate and undergraduate students from  
WSU Vancouver, OHSU, PSU, and PNCA come together to deliver art and  
neuroscience courses at Portland and Vancouver public schools,  
conferences and public events.

**Where have we been?**

Locations shown on the map:

- Skyview High School
- Gardner School of Arts and Sciences
- CAM Junior and Senior High School
- MESA Day
- Cascade Middle School
- HeLa High School
- Madison High School
- Jason Lee Middle School
- Harrison Park k-8
- Franklin High School
- OMNI Brain Fair
- Patton Middle School
- Brain Awareness Lectures
- Sabin K-8
- Vejo Cult Lecture Series

For more visit [www.nwnoggin.org](http://www.nwnoggin.org)

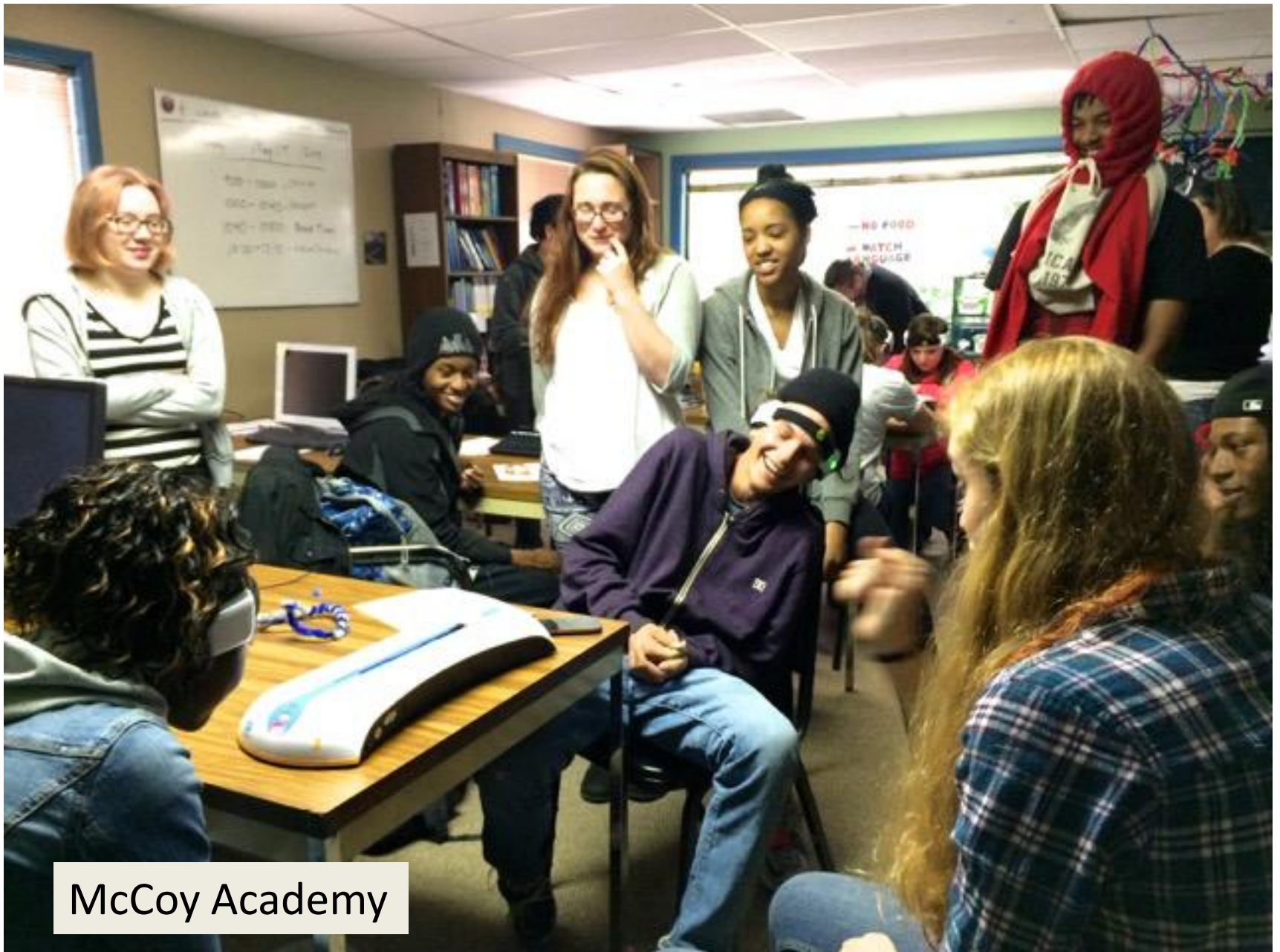




Jefferson High School







McCoy Academy





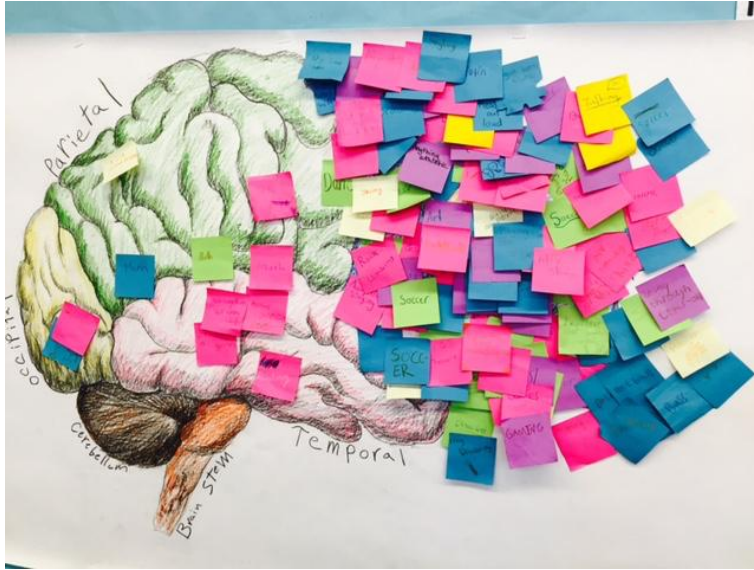
Skyview High School



Velo Cult



# Art projects that...



Serve as examples of concepts

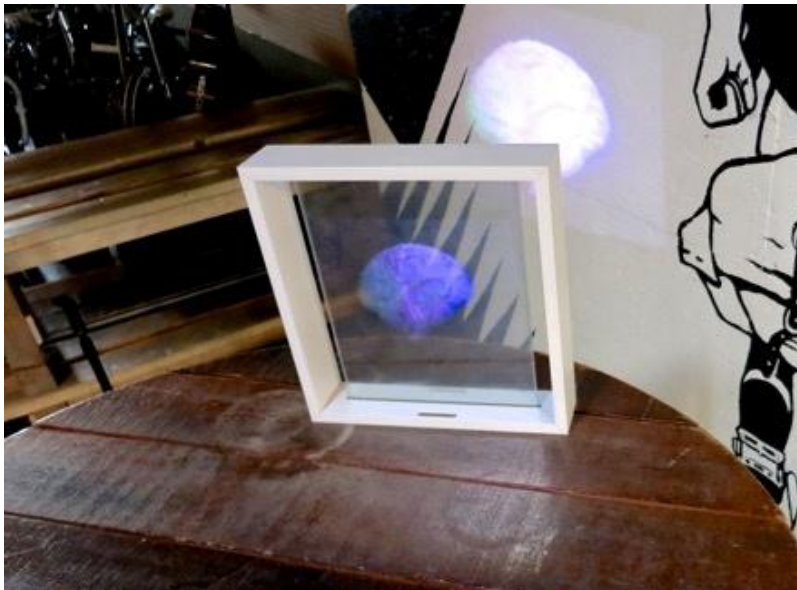
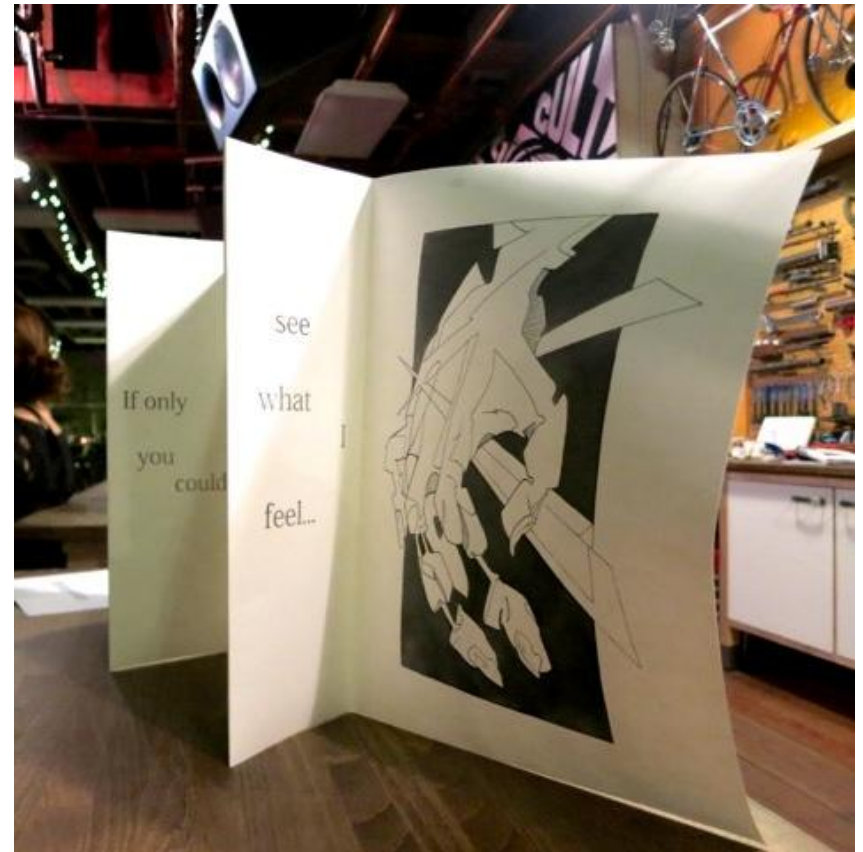


## Illustrate concepts



## Allow students to explore a concept

Artists and art students often reference other fields within their own work





# Hallucinogens

Drugs that produce unusual sensory, perceptual and cognitive distortions



Derived from plants (mushrooms, cacti); but some are synthetic. Include: **mescaline**, **psilocin**, **DMT**, **LSD**



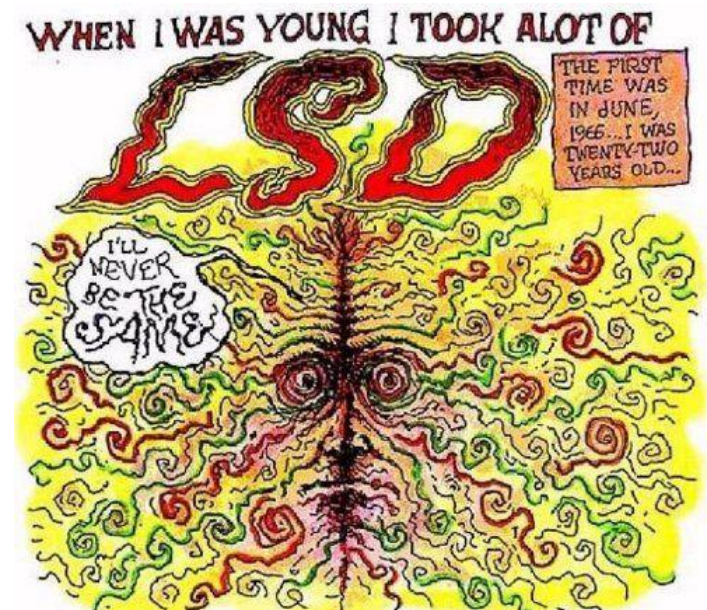
## Depictions of the effects of hallucinogens



**Yan Dargent** "Le rêve d'un éthérés" A depiction of ether-induced hallucinations 1865



**Viktor Oliva** "The absinthe drinker" 1901



**Robert Crumb** "LSD"



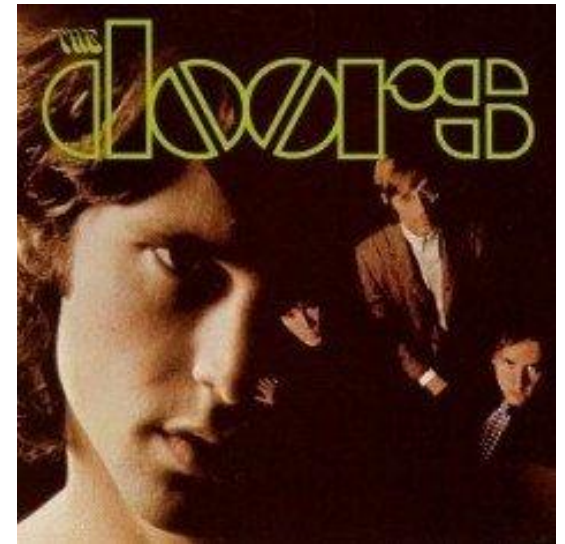
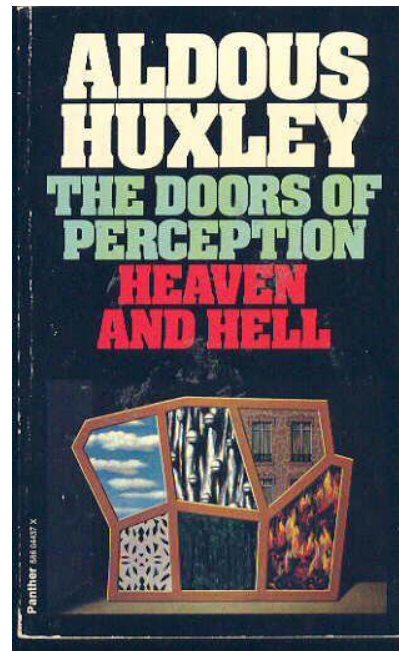
# Mescaline



From dried crown of cacti (including **peyote cactus**). Common in northern Mexico, SW U.S.; used for thousands of years in cultural/religious rituals...

**Aldous Huxley,**  
1950's; 1960's rise in  
U.S. use of peyote

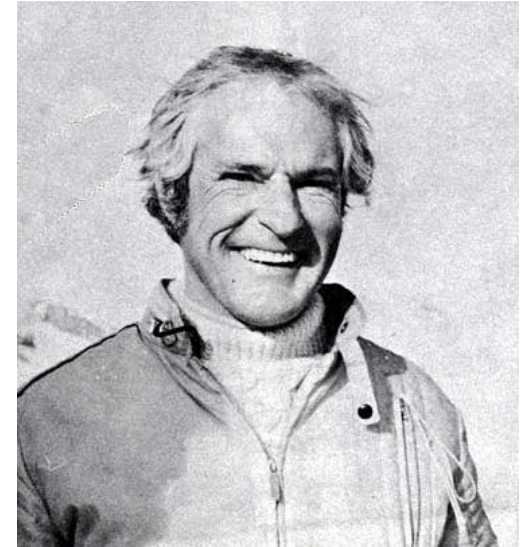
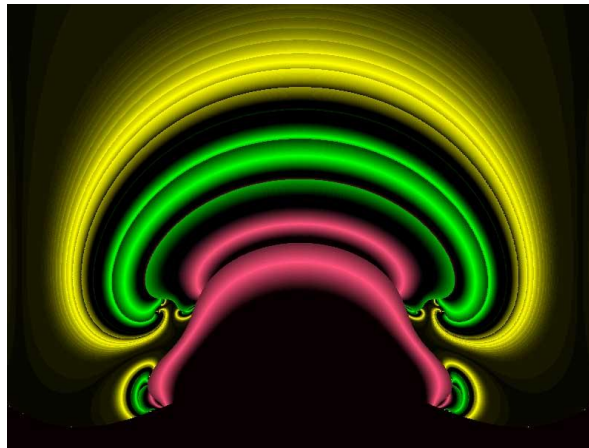
“If the doors of perception  
were cleansed, the world  
would appear to man as it  
is, infinite...” - Blake



# Psilocybin/Psilocin



**Magic mushrooms;**  
psilocybin converted to  
**psilocin *in vivo***



Timothy Leary  
("Turn on, tune  
in, drop out")



Algerian  
cave painting  
3500 B.C.

**Timothy Leary** founded  
the Harvard Psilocybin  
Project (1960 - 1962)



# Ayahuasca (Hoasca)

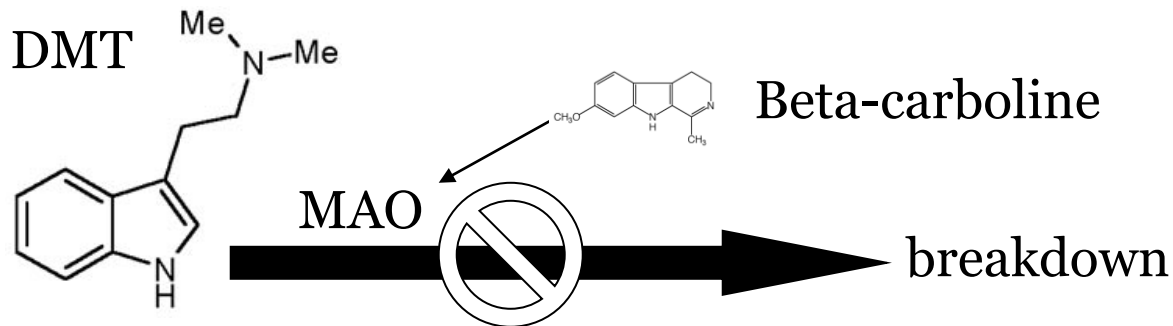
“Vine of the soul”

Brew from plants containing **DMT**  
and **beta-carbolines**



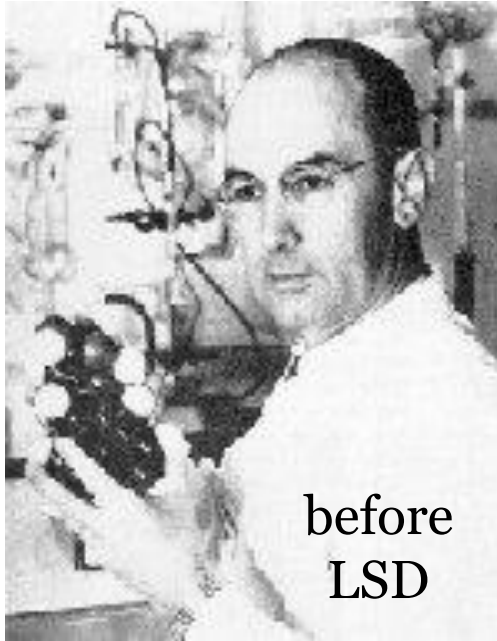
**DMT:** hallucinations,  
cognitive distortions

**Beta-carbolines** *inhibit*  
*DMT breakdown* by MAO



Christian  
Spiritist Sect;  
use protected by  
Supreme Court  
in 2006...

# LSD

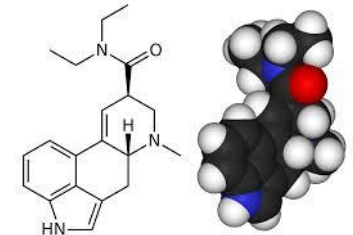


before  
LSD

after LSD!



A synthetic **ergot**  
derivative synthesized by  
**Albert Hoffman** in  
1938 (LSD-25)



Some derivatives toxic; some clinically useful  
LSD re-examined in 1943; Hoffman ingested  
it (by accident) and took an unusual trip!  
**LSD is a very potent drug...**



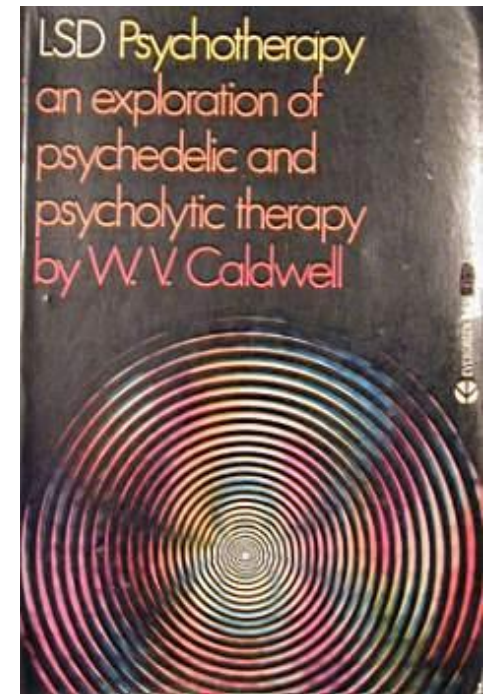
ergot fungus



# Early applications

LSD initially available to psychiatrists and medical researchers (1940 - 1962)

**Psycholytic therapy:** Popular in Europe; LSD in psychotherapy to release repressed memories



**Psychedelic therapy:**

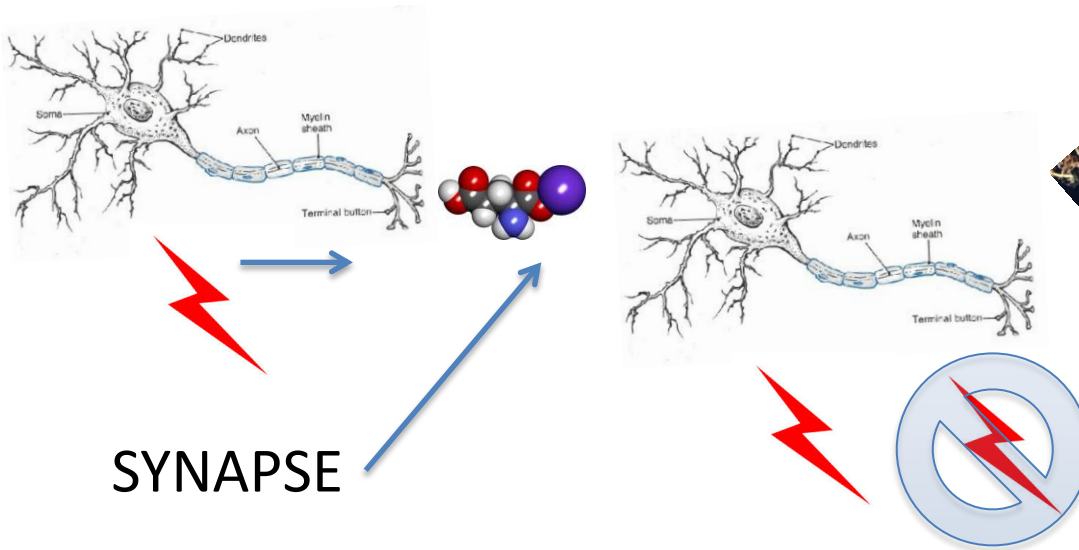
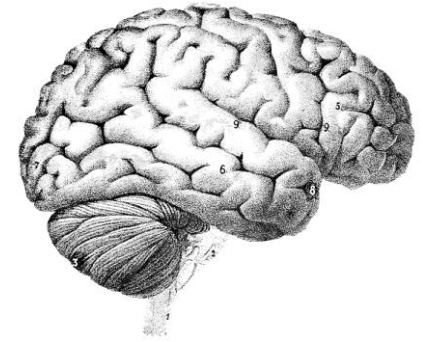
Popular in U.S.; LSD in high doses for “spiritual” shock

**MK-ULTRA:** 1950's CIA program, secret LSD administration to U.S. citizens; [British testing too](#)



# Your brain: made of cells

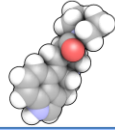
- Neurons
- Neurons carry *electrical* messages
- Neurons connect *chemically* across synapses
- Neurotransmitters



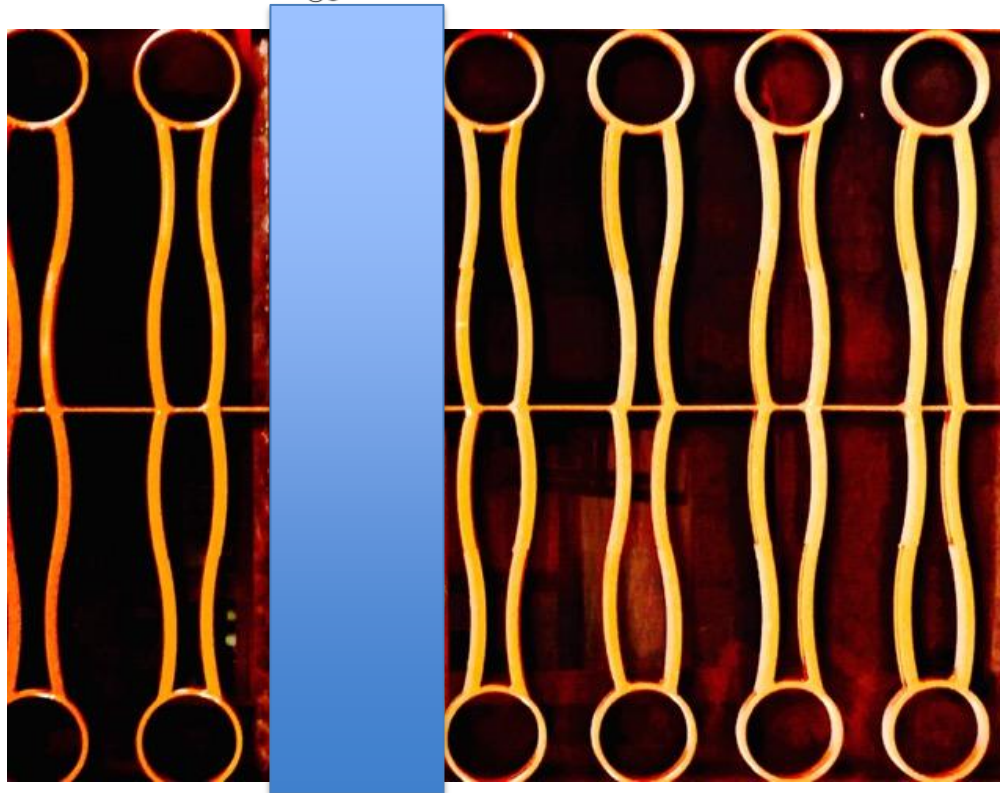


# All cells have membranes

Neurotransmitter  
or drug



Outside cells, including neurons



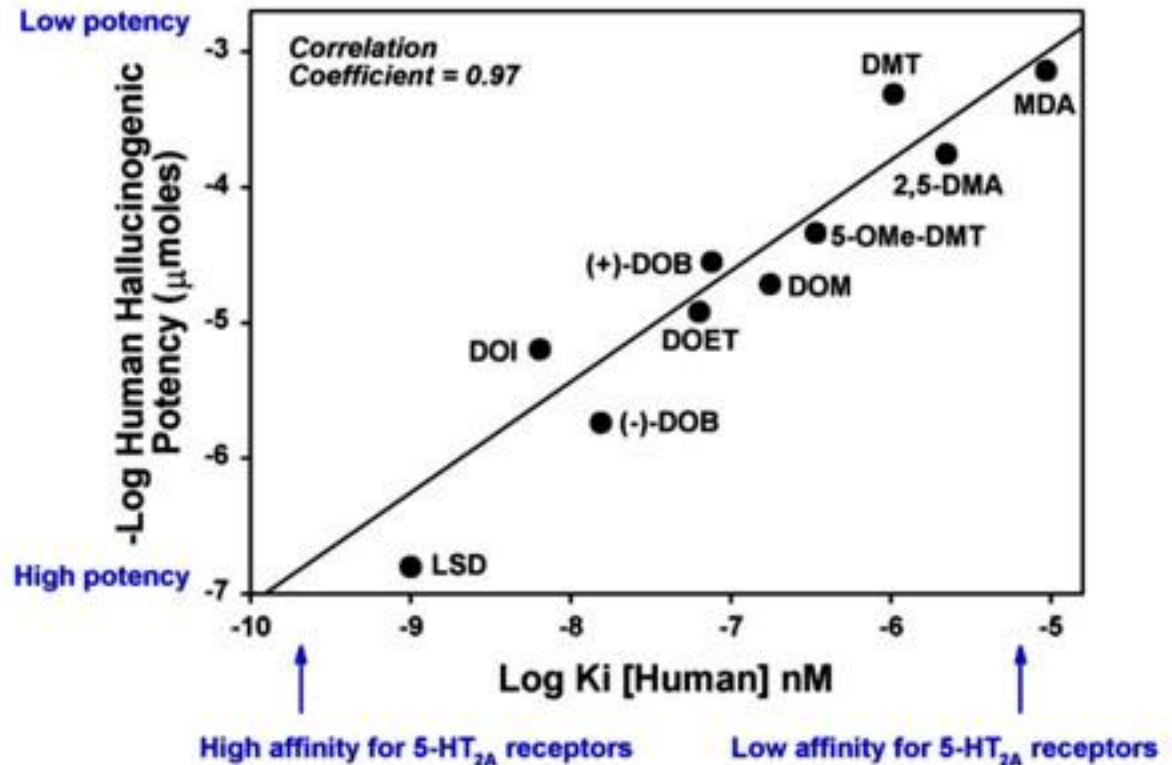
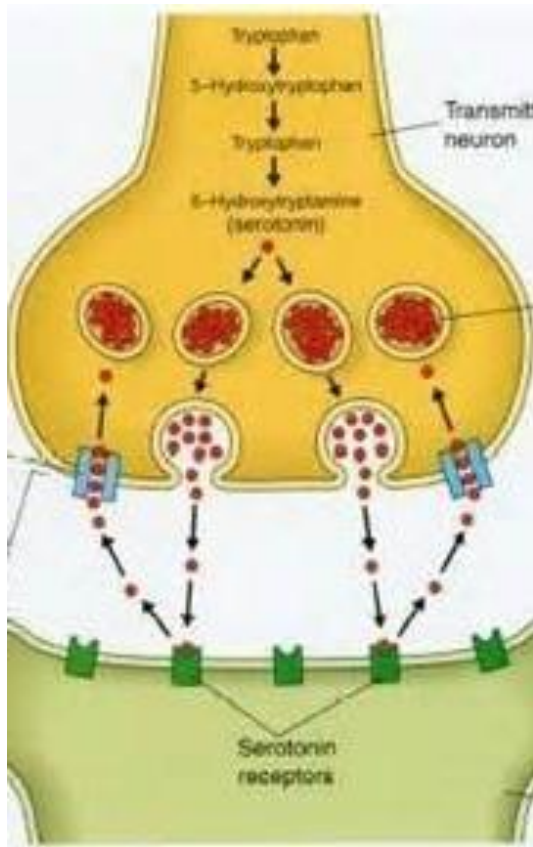
Inside cells

RECEPTORS: "Protein machines"

Many drugs, including hallucinogens, cannot get through, but instead act at RECEPTORS to affect neuron function...

Drugs like LSD attach (or "bind") to receptors, changing the activity of affected neurons...

# All hallucinogens act at ONE type of SEROTONIN receptor (5-HT<sub>2A</sub>)

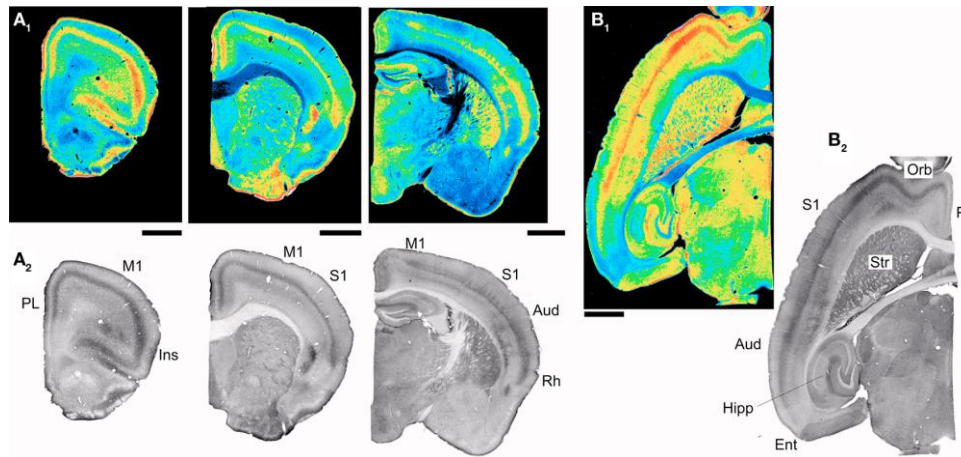


Wenjie Xiao, William E. Fantegrossi (2006)

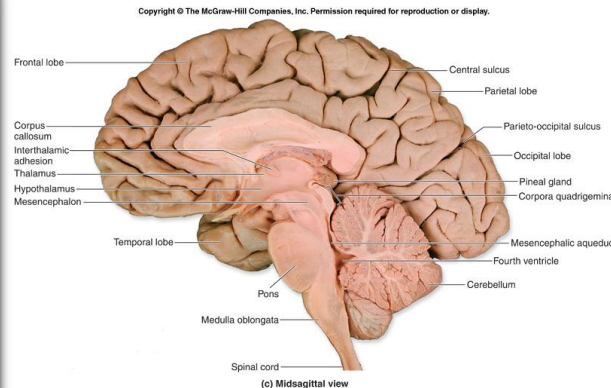
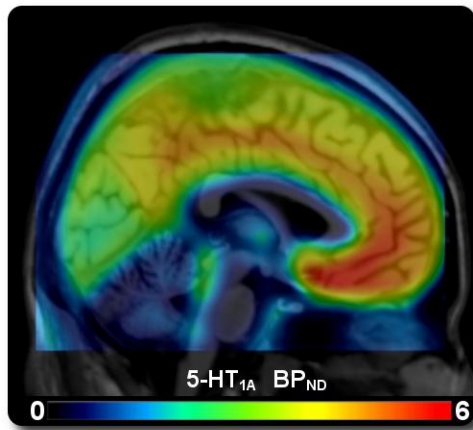
Potency linked directly to hallucinogenic effects



# Where are these receptors?



Virginia Cornea-Hébert (1999)



- Neocortex
  - Layer V
- Olfactory cortex
- Hippocampus
- Basal ganglia
- Thalamus
- Cerebellum
- Brainstem
- Spinal cord

# Changes in perception

“If the doors of perception were cleansed, everything would appear to man as it is, infinite” - William Blake

“The legs, for example, of that chair - how miraculous their tubularity, how supernatural their polished smoothness”  
- Aldous Huxley, “The Doors of Perception” (1954)

“I looked around me and noticed details of physiognomy that had never struck me before. Each pore in my companion’s skin was now visible...”  
- Solomon Snyder, “Drugs and the Brain”

“I clapped my hands and saw sound waves passing before my eyes”  
- Solomon Snyder, “Drugs and the Brain”



Hallucinogens  
affect the “gating”  
of sensory input

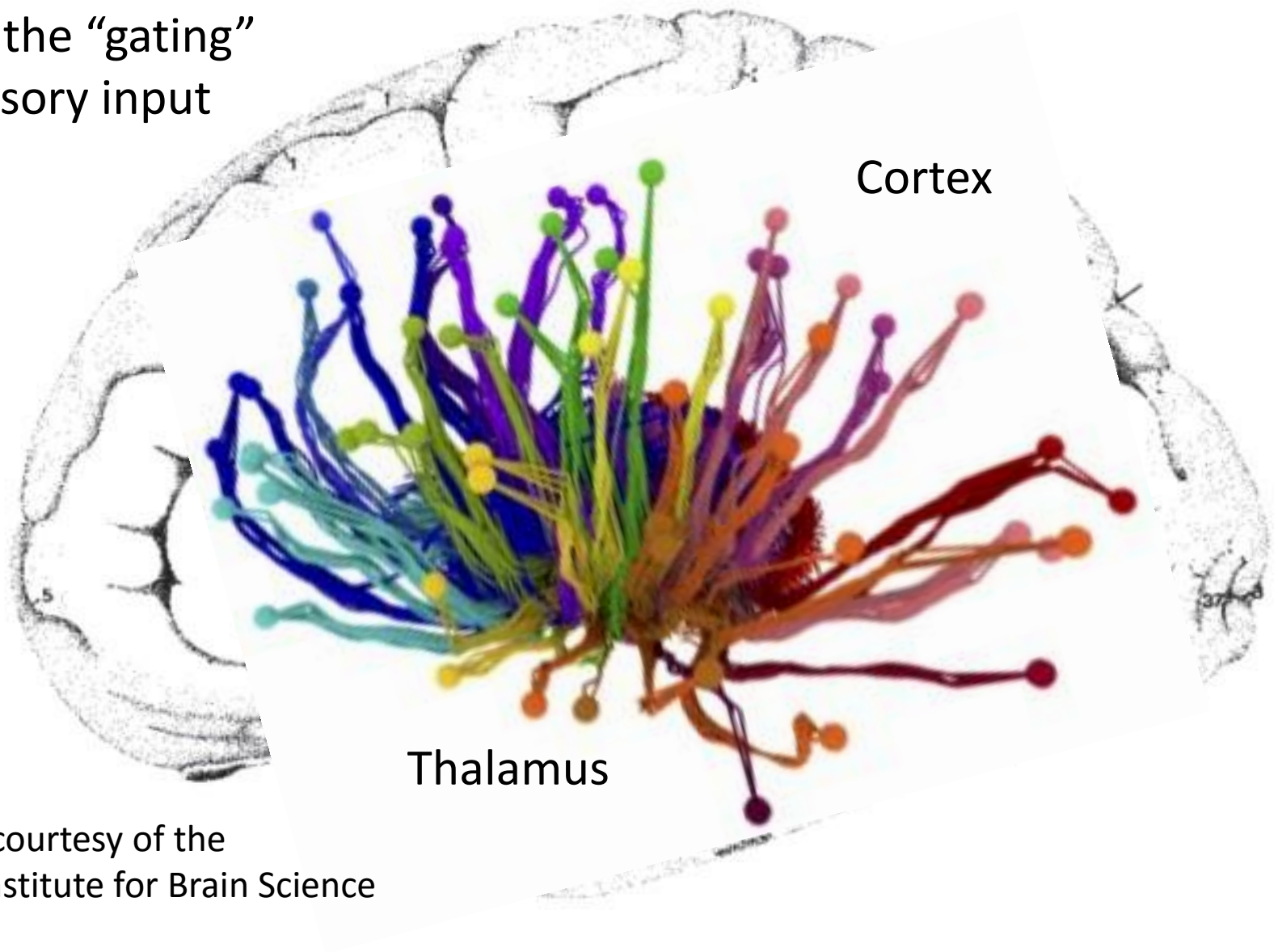
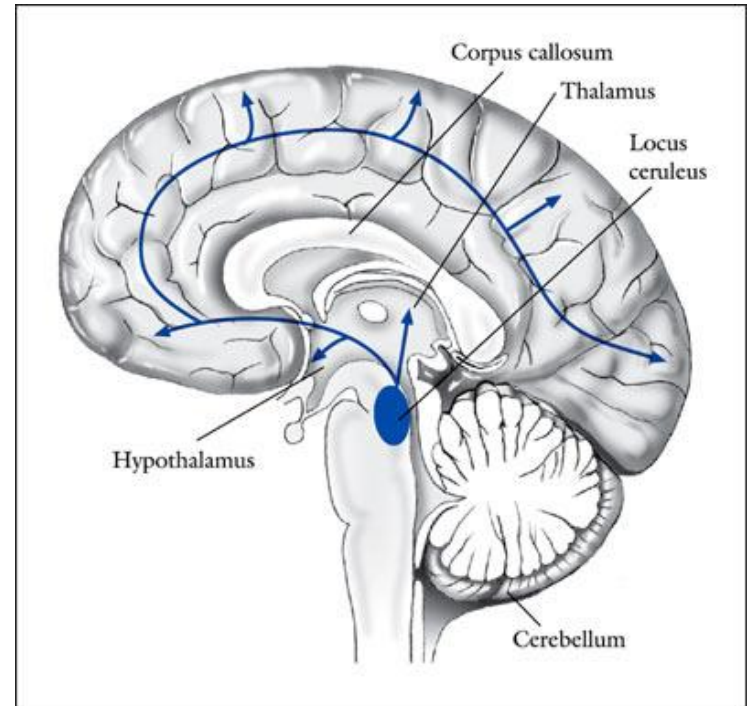


Image courtesy of the  
Allen Institute for Brain Science

# Hallucinogens Enhance Sensory Responses in the Locus Coeruleus via 5-HT<sub>2A</sub> Receptors

*Ordinary  
stimuli become  
extraordinary*



“...it is of interest that the systemic administration of LSD, mescaline, or other psychedelic hallucinogens in rats, although decreasing spontaneous activity, produces a paradoxical facilitation of the activation of LC neurons by sensory stimuli...”  
(Aghajanian 1980; Rasmussen & Aghajanian 1986)





Kusama's vast fields of polka dots, or "infinity nets," as she calls them, were taken directly from her hallucinations.

Yayoi Kusama "Infinity Mirrored Room- Filled with the Brilliance of Life"

[The 50's become the 60's right before your eyes!](#)

# What else do hallucinogens do?

Neural correlates of the psychedelic state as determined by fMRI studies with psilocybin, Carhart-Harris et al, PNAS (2011)

Psychedelic drugs have a long history of use in healing ceremonies, but despite renewed interest in their therapeutic potential, we continue to know very little about how they work in the brain. Here we used psilocybin, a classic psychedelic found in magic mushrooms, and fMRI to capture the transition from normal waking consciousness to the psychedelic state.

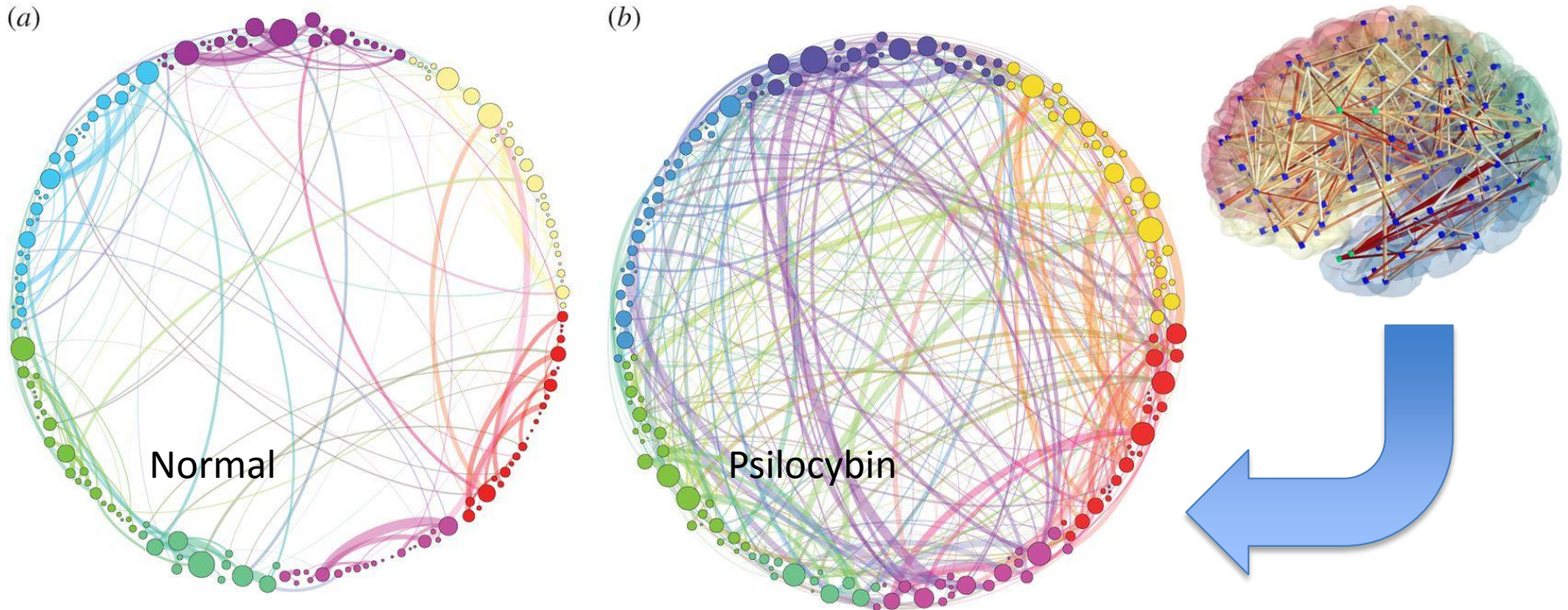
Profound changes in consciousness were observed after psilocybin, but surprisingly, only decreases in cerebral blood flow were seen, maximal in hub regions, such as thalamus and anterior and posterior cingulate cortex (ACC and PCC). Decreased activity in the ACC/medial prefrontal cortex (mPFC) was a consistent finding and the magnitude of this decrease predicted the intensity of the subjective effects.

Psilocybin caused a significant decrease in the coupling between the mPFC and PCC. These results strongly imply that the subjective effects of psychedelic drugs are caused by decreased activity and connectivity in the brain's key connector hubs, enabling a state of unconstrained cognition.



# Greater functional connectivity

Homological scaffolds of brain functional networks, G. Petri, et al (2014)



“there is an increased integration between cortical regions in the psilocybin state... One possible by-product of this greater communication across the whole brain is the phenomenon of synaesthesia which is often reported in conjunction with the psychedelic state...”



Charles Burchfield, *Autumnal Fantasy* 1916-1944



# Changes in sense of “self”

“Worse than the demonic transformations of the outer world were the alterations that I perceived in myself...Every exertion of my will, every attempt to put an end to the dissolution of my ego, seemed to be wasted effort.”

-Albert Hoffman (1948)

“The fear, as I analyze it in retrospect, was of being overwhelmed, of disintegrating under a pressure of reality greater than a mind, accustomed to living in a cozy world of symbols, could possibly bear.”

- Aldous Huxley, “The Doors of Perception” (1954)

“Who am I?”

- Solomon Snyder, “Drugs and the Brain”



William Blake "The Ghost of a Flea" 1819–1820

"There was no doubt that this poor man was mad, but there is something in the madness of this man which interests me more than the sanity of Lord Byron and Walter Scott."

William Wordsworth

This image came to Blake during an 1819 séance.

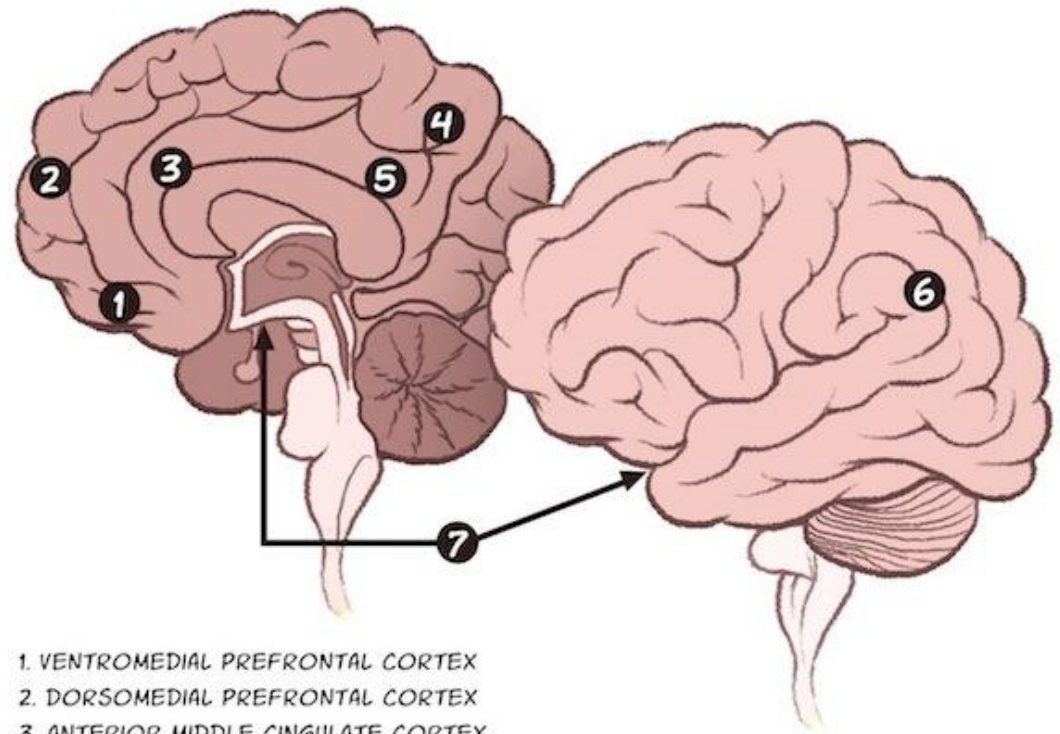
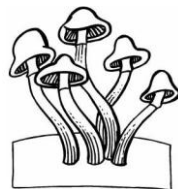
Blake often said that he was joined by invisible sitters as he drew them, including, he claimed, a number of angels, Voltaire, Moses and the Flea, who told him that "fleas were inhabited by the souls of such men as were by nature blood thirsty to excess."



# “Default mode” network

Critical for...  
Self-reflection  
Self awareness  
Rumination

*Decreased* activity  
on hallucinogens  
(psilocybin)



1. VENTROMEDIAL PREFRONTAL CORTEX
2. DORSOMEDIAL PREFRONTAL CORTEX
3. ANTERIOR MIDDLE CINGULATE CORTEX
4. PRECUNEUS
5. POSTERIOR CINGULATE CORTEX
6. INFERIOR PARIETAL LOBULE
7. HIPPOCAMPUS

Source: Immordino-Yang, M.H., Christodoulou, J.A., & Singh, V. (2012). Rest is not idleness: Implications of the brain's default mode for human development and education. *Perspectives on Psychological Science*, 7, 352-364. Adapted with permission.

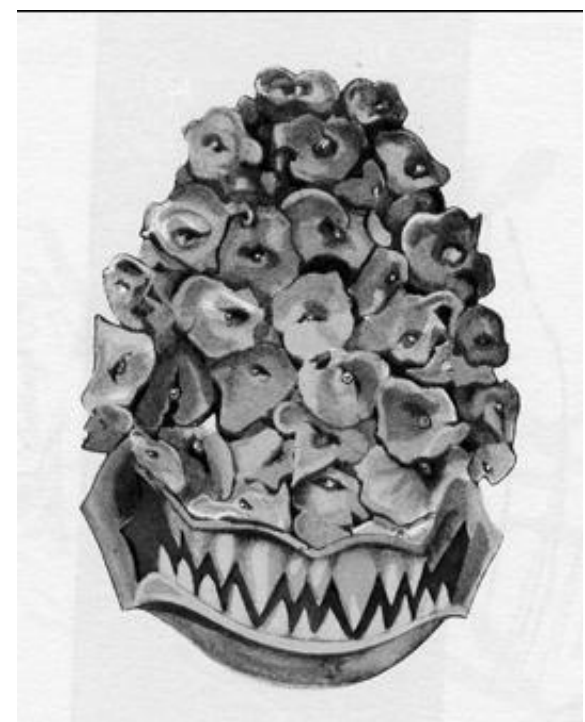
Carhart-Harris et al, PNAS (2011)

## Is there a link between creativity and hallucinogens?



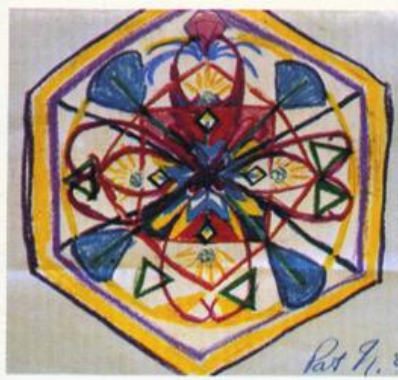
Created under the influence of a psychedelic in a clinical setting (Roubíček 1961)

mushroom-inspired image created by a French subject in Paris.



From the early 1900s until about 1980 there was a great deal of interest in using hallucinogens to research creativity. In one early experiment in 1927 researchers injected subjects with morphine and asked them to illustrate their visual experiences.

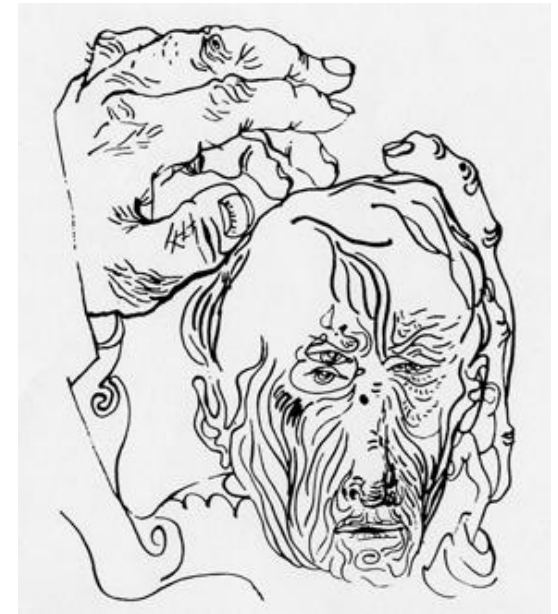
Subject #17 was a doctor who was given 400 mg. Looking at a rug, she commented, "The whole carpet seemed to me without sense." She drew a stylized crab, an animated form that she imagined in the carpet.



Mandalas created before (left) and during (right) an LSD session conducted in 1972 at the Maryland Psychiatric Center

In 1952 László Mátéfi described how an experimental subject under the influence of a hallucinogen experienced a discrepancy between his intention and performance while making a portrait:

I see the object correctly but draw it falsely; my hands won't follow it.... This desire to paint is harder and harder for me to perform since the expanse of my experience pulls me more and more into it. Myself, the drawing, and the surroundings create a unity--and that hinders me because I cannot concentrate on the model. I have the need to bring everything including the painted picture into the surface of the image. Had the painting process been more of a technical success, I would have been able to produce a fantastically good work

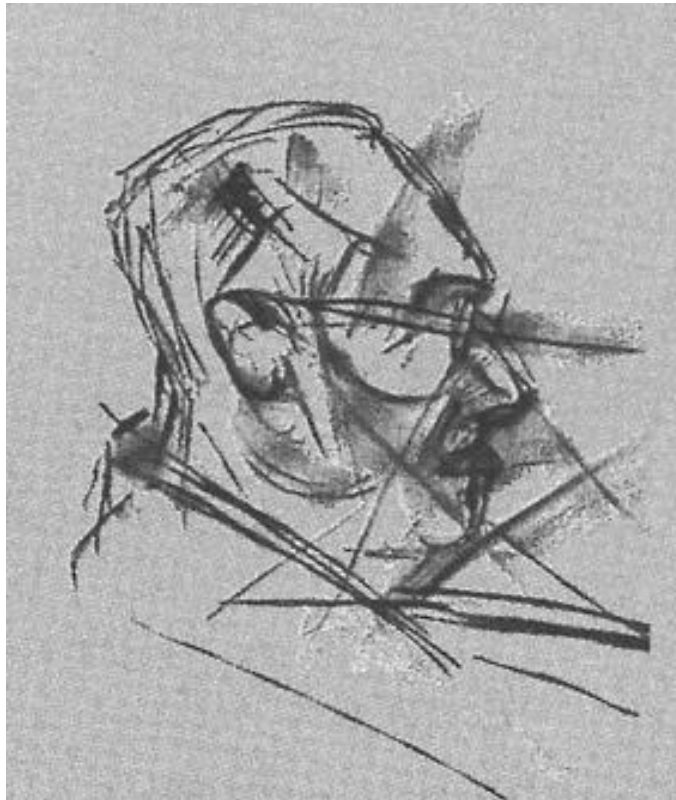


Distortion of body extremities is illustrated in a sophisticated way by a professional painter. This drawing was executed by a well-known Czech artist after the recovery from LSD intoxication.





*A drawing of a model made by  
an experimental subject only  
20 minutes after taking a dose  
of LSD.*

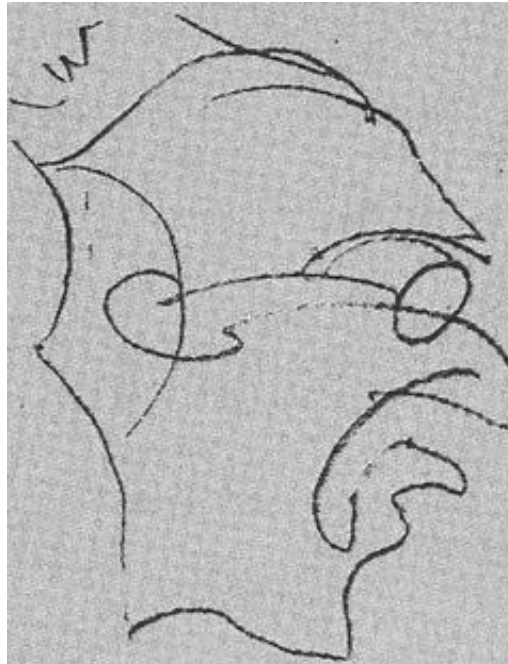


*After an hour and 25 minutes  
the subject sees the model  
clearly, but his hands are  
making sweeping movements.*



*Two hours 30 minutes: the  
subject feels that his  
consciousness resides in  
his drawing hand.*





*Shortly after the previous drawing, the subject feels he has captured a likeness in one sweep of his hand.*



*Two hours 45 minutes:  
everything is kaleidoscopic  
and mobile. The model's face  
has become diabolical.*

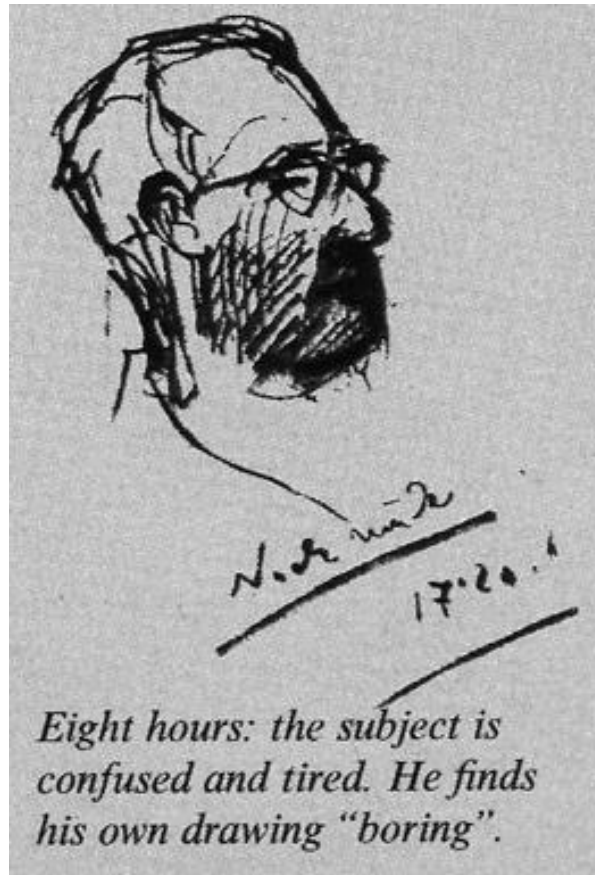


*Four hours 25 minutes: the  
world grows quieter.*





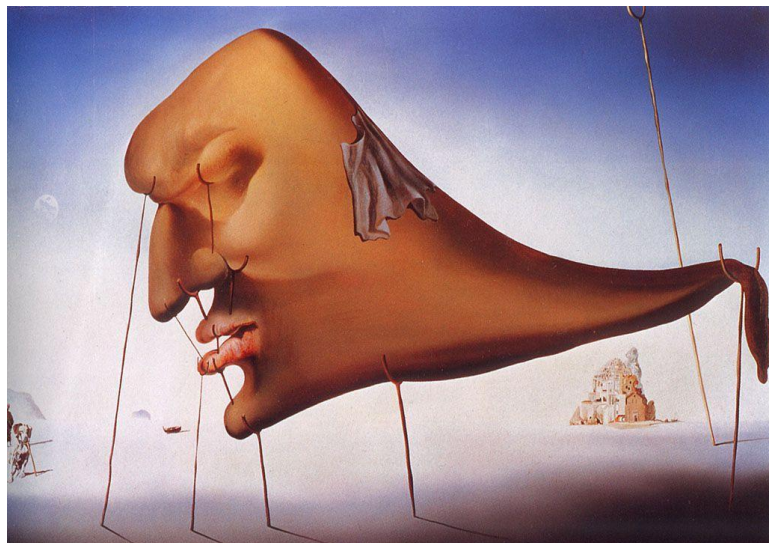
*Five hours 45 minutes: the  
world ebbs and flows.*



*Eight hours: the subject is  
confused and tired. He finds  
his own drawing "boring".*

## What artists come to mind when thinking of hallucinogenic drugs?

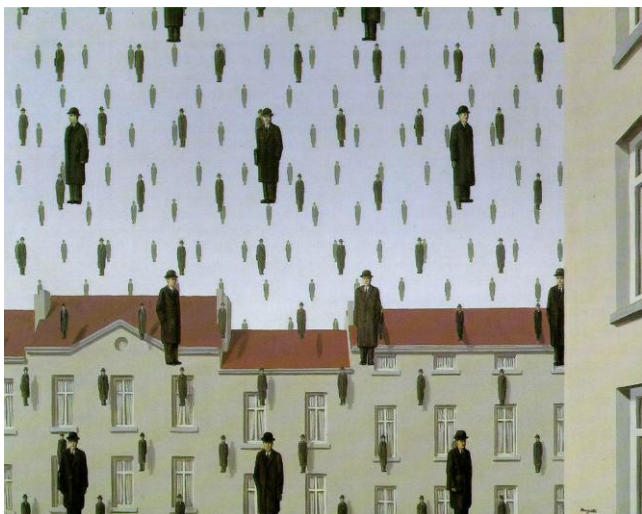
Salvador Dali



Hieronymus Bosch



Rene Magritte



Jackson Pollock





# Hallucinogens as a strategy for making art

## Stanislaw Witkacy

**Type A** -- Suitable rather for women's faces than for men's. Slick execution, with a certain loss of character in the interest of beautification or accentuation of "prettiness".

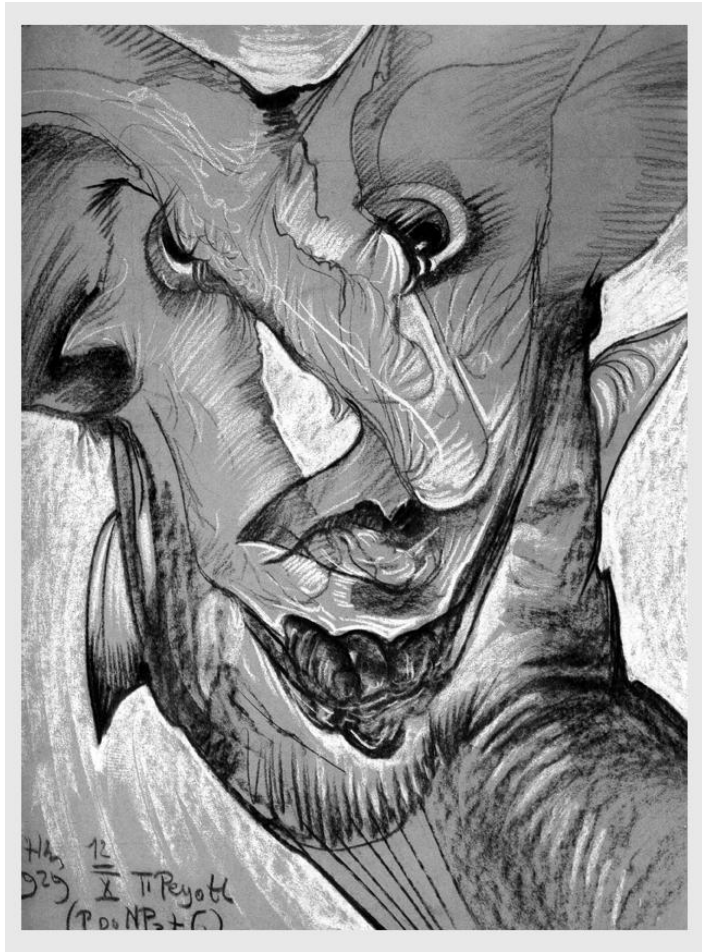
**Type B** -- Intensification of character, bordering on caricature. The head larger than natural size. The possibility of preserving "prettiness" in women's portraits, and even of intensifying it in the direction of the "demonic."

**Type C, C + Co, E, C + H, C + Co + E, etc.** -- Subjective characterization of the model, caricatural intensification both formal and psychological are not ruled out. Approaches abstract composition, otherwise known as Pure Form.

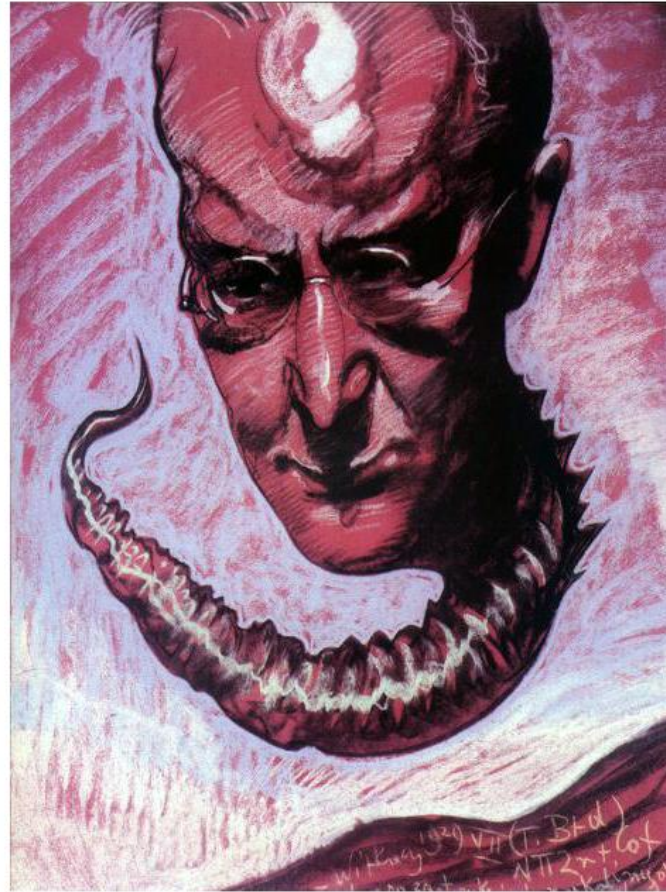


Stanislaw Witkacy "Self-portrait" 1938

Witkacy made this portrait under the influence of mescaline.



Stanislaw Witkacy “Teodora Bialynickiego-Birul” 1929



Witkacy made this portrait under the influence of peyote.

Stanislaw Witkacy “Neny Stachurskiej” 1929





Henri Michaux "Dessin Sous Mescaline" 1956

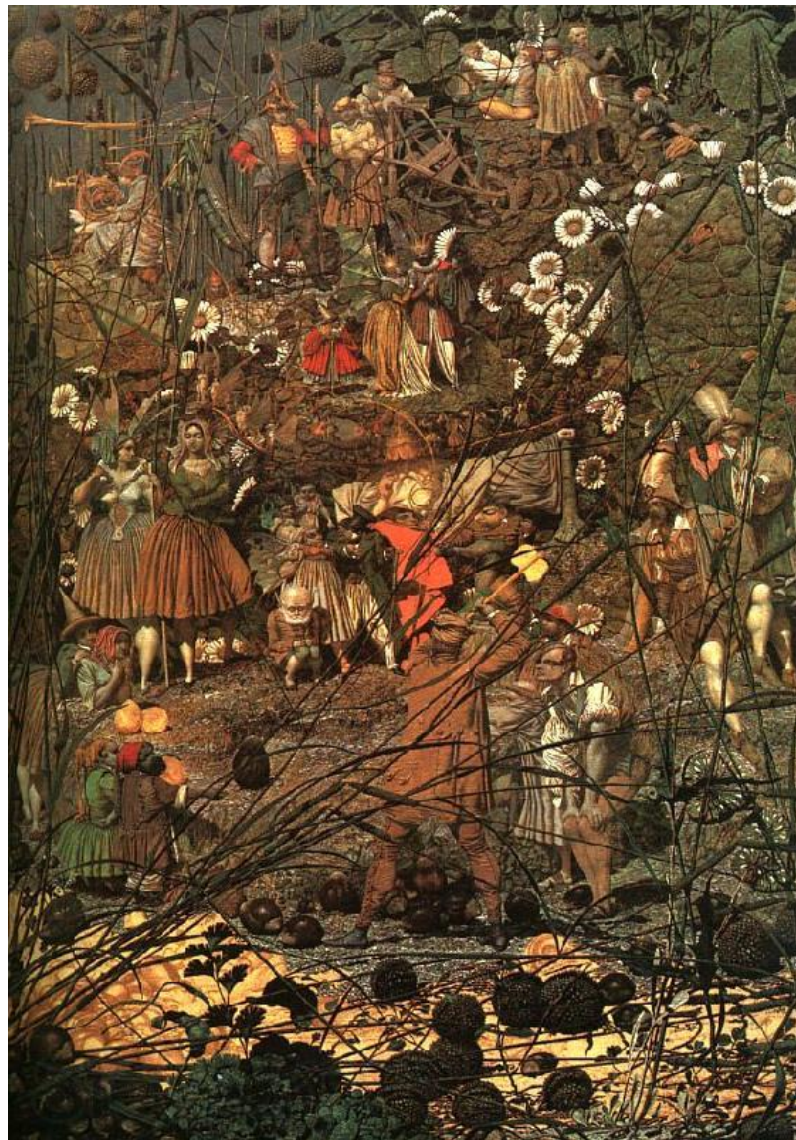


Henri Michaux "Dessin Sous Mescaline" 1962

Michaux's self-transcended drawings "*Dessin mescalinen*" from 1956/1957 – were done during various phases of neurological excitement induced by mescaline



## Other forms of hallucination in art



Richard Dadd *"The Fairy Feller's Master-Stroke"*  
1855–64

One suggestion in Sack's "Hallucinations" is that many stories of fairies and leprechauns may be a result of CBS hallucinations exasperated by macular degeneration.

Dadd however suffered from violent delusion and hallucinations likely a result of schizophrenia



Following the death of his sister in 1897 Ernst described a hallucination he experienced in which the wood grain on a panel near his bed took on "successively the aspect of an eye, a nose, a bird's head, a menacing nightingale, a spinning top, and so on."

Max Ernst "Two Children Are Threatened by a Nightingale" 1924



# Claude Monet



"Water Lillies" 1905



"Water Lillies" 1914

Monet suffered from acute macular degeneration in the latter stages of his career



"Grandes Decorations" 1920



How have artists manipulated these same systems to create a greater sense of visual and emotional impact?

**Exaggeration of color**



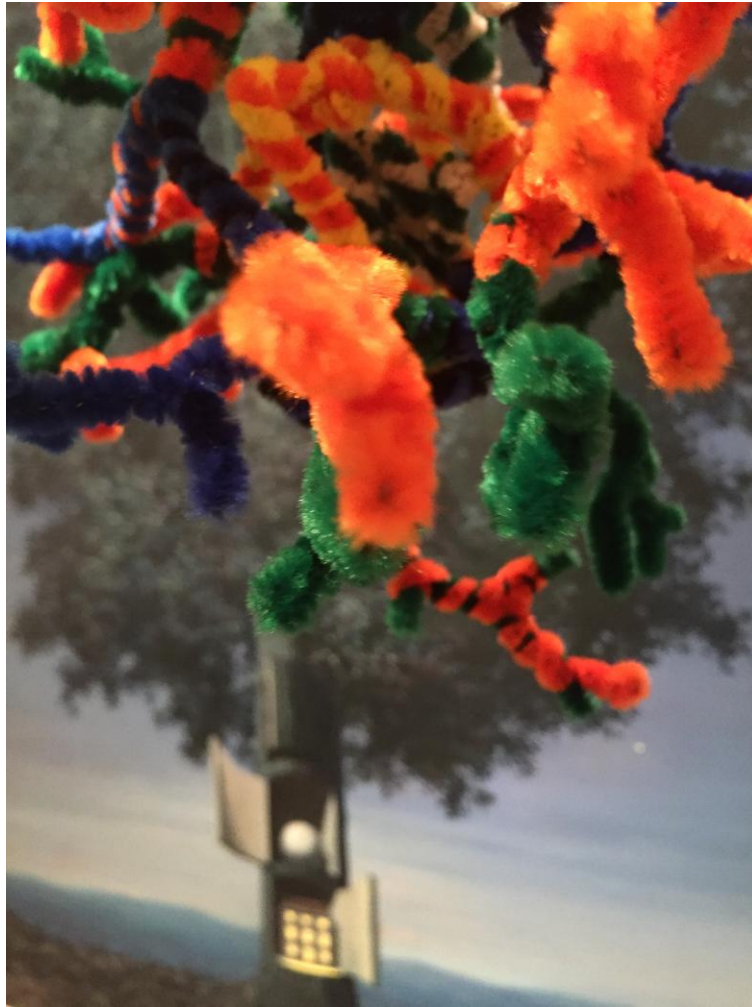
David Hockney "The Grand Canyon"

The exchange of natural forms into patterned elements



Gustav Klimt "Birchenwald"

## Unusual juxtapositions



Rene Magritte "The Voice Of Blood" + Brain Cell